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# Einstein on the Beach: A Global Analysis

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*EINSTEIN ON THE BEACH: A GLOBAL ANALYSIS*

by

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A THESIS

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# *EINSTEIN ON THE BEACH: A GLOBAL ANALYSIS*

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University of Nebraska, 2014

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*Einstein on the Beach*, the minimalist opera by Philip Glass, represents the culmination of a unique musical style within the minimalist genre developed by Glass over several decades. Since its premiere, only two analyses have been offered for the music of this opera, by Glass himself, and by Keith Potter. These analyses have provided valuable insight as to specific details of this work, but a large-scale, global analysis can also be undertaken, offering valuable insight into the overall structure of the work and also into the musical language created by Glass. Analyzing the key harmonic themes of the opera, taking into account the various rhythmic structures perpetuated by Glass, such as additive, subtractive, and cyclic structures, shows a specific focus on key centers separated by half step. These analytic decisions are made by taking into account the clarity and emphasis given to key centers and collections based on features such as repetition, duration, and register, as well as their appearance in climactic and structural scenes. F and A prevail as the dominant key areas, along with C, which appears as a tertiary focus. Taken together, F, A, and C themselves differ by only one half step to F minor, which is the central harmony in the main harmonic theme of this opera. This analysis shows the overall sense of harmonic structure created by Glass, even in a work that is characterized by its unique construction and sonic effect.

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## CHAPTER 1: INTRODUCTION

Philip Glass's minimalist opera, *Einstein on the Beach*, premiered in 1976, and its peculiar nature, both in the music and the on-stage action, provided fodder for a number of reviews, descriptions, and commentaries. For example, in the year following the premiere, David Cunningham published an article describing the elements of thematic structure in terms of the identifiable elements present throughout the opera, such as the train, the trial, and the field, as well as describing the actions of the performers themselves.<sup>1</sup> These descriptions bring to light an understanding that this opera greatly differs from the usual conception of opera as a genre. *Einstein* has neither an identifiable plot nor named characters. It proceeds uninterrupted for nearly five hours, and audience members are welcome to come and go as they please. As K. Robert Schwarz writes, "Since there would be neither character development nor conventional narrative, *Einstein* would be given shape by means of its continuous music and recurring visual images."<sup>2</sup> These images were meant to reflect, often in a metaphorical sense, Albert Einstein's life and work without telling his literal life story. For example, the train that appears in two scenes is meant to represent the theory of relativity, in the sense that the train and the relationships between passing trains are often used within mathematical equations that explain and use this theory. This train eventually becomes a building, representing the postulation of this theory as a natural law, so that it has transformed into something fixed

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<sup>1</sup> David Cunningham, "Einstein on the Beach," in *Writings on Glass: Essays, Interviews, Criticism*, ed. Richard Kostelanez and Robert Flemming (New York: Prentice Hall International, 2000), 152-166.

<sup>2</sup> K. Robert Schwarz, *Minimalists* (New York: Phaidon Press Limited, 1996), 131.

or unmoving.<sup>3</sup> More important to Glass than presenting specific images with concrete meanings was a sense of a “poetic vision” of Einstein.<sup>4</sup> The images shown in this opera can be connected to Einstein’s life, but assigning specific meanings to each symbol is not the main focus of the work. Glass summarizes this perspective, writing, “The point about *Einstein* was clearly not what it ‘meant’ but that it was *meaningful* as generally experienced by the people who saw it.”<sup>5</sup> The individual scene types physically take place in different areas of the stage, as the “Field/Spaceship” scenes represent a landscape seen at a distance, the “Trial” scenes are at a middle distance and represent still lifes, and the “Knee Plays” are foreground portraits.<sup>6</sup> The “Knee Plays” appear before and after each act, and their name reflects their function, as the “knee” refers to the joining function of the human knee, connecting two parts of the leg.<sup>7</sup> Despite this function, the “Knee Plays” are far from being simply interludes. Instead, these joining scenes serve to heighten the dramatic effect of the opera as a whole through their interaction with earlier-heard harmonies and introduction of their own harmonic ideas.<sup>8</sup> The basic staging ideas of the scenes in each act are made clear by their titles, and these scene titles are presented in order in Table 1.

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<sup>3</sup> David Cunningham, “Einstein on the Beach,” 152

<sup>4</sup> Philip Glass, *Music by Philip Glass*, 32.

<sup>5</sup> Ibid., 33.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid., 30

<sup>8</sup> Ibid., 33

	“Prologue”
	“Knee Play 1”
Act I:	
	“Train”
	“Introduction to Trial”
	“Trial”
	“Knee Play 2”
Act II:	
	“Dance 1”
	“Introduction to Night Train”
	“Night Train”
	“Knee Play 3”
Act III:	
	“Trial/Prison”
	“Dance 2”
	“Knee Play 4”
Act IV:	
	“Building”
	“Bed”
	“Spaceship”
	“Knee Play 5”

Table 1. Order of scenes in the opera.

Cunningham offers comments on the music itself, although the analysis he provides is vague, avoiding specifying key or note names. About the music that accompanies a descending bar of light in the opera, first seen in “Train,” he writes, “It seems to be a scale with some of the notes left out and the remainder extended to fill the space. Then notes are slowly brought in and taken out . . . Here a lot more attention seems to have been paid to the basic material and the exact procedure by which it is treated.”<sup>9</sup> Cunningham is correct that the musical focus is on the transformation of basic structures through rhythmic processes, however, his lack of specificity represents the trend of writing about *Einstein* in terms of musical analysis, which is largely non-specific in terms of harmony.

In his book, *Minimalists*, K. Robert Schwartz also provides commentary on this opera, in first describing the unique on-stage features of the work, and then progressing to a description of the music. His comments in this regard are brief, however, as he says, “There are the familiar hyperactive eighth-note lines that expand and contract by means of an additive process, but there are also calmer, more incantatory sections, such as when the chorus ritualistically chants the numbers and solfège syllables.”<sup>10</sup> Again, his comments are valid, yet remain at the surface of the score, rather than exploring its details for an increasingly extensive understanding of the opera. Schwarz also identifies Glass’s “new fascination with the power of harmonic motion to shape and unify a large-scale structure.”<sup>11</sup> Despite this assertion, he makes no further claims about the harmonic

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<sup>9</sup> David Cunningham, “Einstein on the Beach,” 156

<sup>10</sup> K. Robert Schwarz, *Minimalists* (New York: Phaidon Press Limited, 1996), 136.

<sup>11</sup> Ibid.

content of the work. Similar statements appear in Robert Maycock's *Glass: A Portrait*, as he says about the music of *Einstein*, "It is just a matter of letting the progressions build up into substantial structures."<sup>12</sup> These analysts agree that large-scale structures exist in *Einstein on the Beach*, composed of smaller-scale harmonic and rhythmic ideas, but leave any analysis at that point.

Music theorists have offered basic analyses of other works by Glass that are in this same style. In his article about *Music in 12 Parts*, a set of pieces that Glass completed in 1974, Tim Page gives a brief analysis of this piece, which precedes and prefigures the structures in *Einstein*. His explanation of Part XI is brief, yet enlightening, as he explains that it differs from the other, harmonically static movements due to the harmony changes with each changing figure. He states that this burgeoning focus on harmonic motion in combination with rhythmic structures is a clear allusion to what is to come in *Einstein*.<sup>13</sup> In "Form and Process," Wes York describes Glass's rhythmic structures in terms of *Two Pages*, a similar work. He briefly explains subtractive and additive processes as the subtraction or addition of a note or notes to a pattern, expanding or contracting the pattern.<sup>14</sup> These processes, along with repetition, are important features in the structure and development of *Einstein*. York also indicates that this rhythmic structure has harmonic consequences as well, such as in his description of part III, in which he states, "The repetition of D-E-flat-F-D-E-flat builds expectation for a return to the note G. In contrast, the repetitions of C-D-E-flat-F at the end of part IV give the

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<sup>12</sup> Robert Maycock, *Glass: A Portrait* (London, Sanctuary Publishing Limited, 2002), 36.

<sup>13</sup> Tim Page, "Music in 12 Parts," in *Writings on Glass: Essays, Interviews, Criticism*, ed. Richard Kostelanez and Robert Flemming (New York: Prentice Hall International, 2000), 152-166.

<sup>14</sup> Wes York, "Form and Process," in *Writings on Glass: Essays, Interviews, Criticism*, ed. Richard Kostelanez and Robert Flemming (New York: Prentice Hall International, 2000), 63-64.

central note C more weight.”<sup>15</sup> This idea of rhythmic weight providing harmonic weight is an important development in Glass’s style. Despite the innovative features of Glass’s compositional voice that are so greatly exemplified in *Einstein*, there is very little existing analysis of the music of this opera, although such analysis does exist in descriptions of smaller musical events within the work.

Written in 1987, just over a decade after the premiere of *Einstein on the Beach* in 1976, *Music by Philip Glass* offers the composer’s own, albeit brief, comments on the work. In this book, Glass describes the particular rhythmic techniques used in the opera and the harmonic features that are carried by these rhythmic structures. From his initial presentation of his characteristic rhythmic techniques as shaping the harmonic details of the music, he is establishing a hierarchy of musical features, with rhythm taking precedence over harmony. However, Glass clarifies that *Einstein* ultimately represents the culmination of a fusion of his ideas on rhythm and harmony into a single, unique musical language of his own design.

The first and primary structural components that Glass describes in terms of this opera are additive process and cyclic structure. He did not develop these techniques through or for *Einstein* alone. Glass mentions that his *Music in Twelve Parts*, which was written between 1971 and 1974, is “a catalogue of ideas on rhythmic structure” from which these techniques evolved.<sup>16</sup> Glass describes the aim of this earlier work as his way of fully developing and realizing the possibilities of his idea of using rhythmic structure to generate overall form, which he had been contemplating since 1965 in the time he wrote the music for Beckett’s *Play*, and was particularly influenced by his association

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<sup>15</sup> Ibid., 75.

<sup>16</sup> Philip Glass, *Music by Philip Glass*, 58.

with Ravi Shankar and Ustad Alla Rakha Khan. The results of this effort of exploring the possibilities inherent in Glass's rhythmic structures became *Music in Twelve Parts*, in which each "part" depends on a particular rhythmic technique, with sections concentrating on cyclic, additive, or repetitive structures.<sup>17</sup> In this work, Glass found that the places in the music that joined each "part" to the next could be heard as modulations in a rhythmic sense, as one overall rhythmic scheme transitions to another. Thus, Part 11 of this work is an exploration of these different modulations. Additionally, Part 12 is concerned with the cadential structures that are familiar to listeners of Western music, and is itself the "cadence" to the larger work as a whole.<sup>18</sup> Through this extended work, Glass was able to assimilate the possible uses of his own rhythmic ideas in preparation for writing *Einstein*.

Glass makes a particular point of noting that the music of *Einstein on the Beach* developed naturally from his earlier work. His work with modulation and cadence, developed in *Music in Twelve Parts*, served as the basis for *Another Look at Harmony, Parts 1 and 2*, the music for which ultimately became the music for the scenes titled "Train" and "Dance 1" in *Einstein*.<sup>19</sup> Glass's reflections on his own works make clear the idea of a natural progression in the development of his style. His rhythmic ideas used in *Einstein* are those that developed from his initial preoccupation, beginning in 1965, with overall rhythmic structure. Glass was methodical in his attempts to fully realize the

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<sup>17</sup> Ibid., 38.

<sup>18</sup> Ibid.

<sup>19</sup> Philip Glass, *Music by Philip Glass*, 38.



possibilities of his thoughts on rhythm. For Glass, *Einstein on the Beach* represents the culmination of his years of work with these structures.

In *Music By Philip Glass*, the composer explains his techniques of additive process and cyclic structure, which are the two main techniques that developed from his work with rhythmic structure. Glass first explains additive process as a technique in which a musical grouping, which he refers to as measures, of a particular number of notes is repeated several times, followed by a measure containing one additional note, also repeated several times. He uses the example of a measure of five notes which, after being repeated, is followed by a repeated measure of six notes, then seven, and so on. About this process, he says, “A simple figure can expand and then contract in many different ways, maintaining the same general melodic configuration but, because of the addition (or subtraction) of one note, it takes on a very different rhythmic shape.”<sup>20</sup> This musical language is unique in that it uses a repeating melodic configuration, and, through the addition or subtraction of a single note at a time, it establishes, as Glass says, “a very different rhythmic shape” for the same repeated figure.<sup>21</sup> This idea of additive or subtractive process is theoretically simple in that it involves the addition or subtraction of one note at a time to generally small melodic figures, which are themselves repeated multiple times. However, this process, when carried out over a long stretch of music, leads to a complex structure overall.

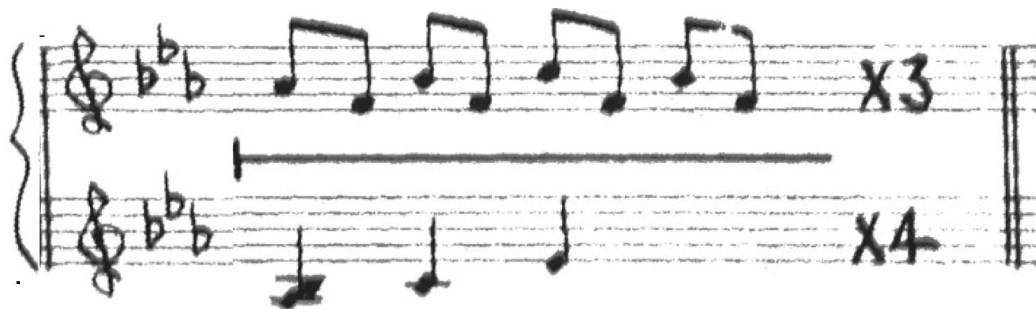
Glass also explains that additive process does not exist in isolation. He combines additive process with cyclic structure, which is described as rhythmic cycles or

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<sup>20</sup> Ibid., 58.

<sup>21</sup> Ibid.

“repeating fixed rhythmic patterns of specific lengths.”<sup>22</sup> In essence, this procedure involves the combination of melodic figures, which are the same as those used in additive process. Combination in this sense simply involves playing these figures at the same time. However, in cyclic structure, the figures that are combined are of different lengths. For example, a melodic figure consisting of four eighth notes may be combined with a figure consisting of three quarter notes. The first melodic figure, which consists of four beats, is repeated three times, while the second, and aurally concurrent, figure, which consists of three beats, is repeated four times. In this example, three repetitions of the first figure will take the same time as four repeats of the second figure until both reach completion at the same time.<sup>23</sup> In this process, the same figures are repeated, but the aural effect differs with each repetition as the different lengths of the figures cause the combination of sounds to differ with each repetition. Glass uses the opening of “Train” to illustrate this process, shown in Example 1.1, which reflects measure 2 of the organ 1 part.



Example 1.1. Figure 2.

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<sup>22</sup> Philip Glass, *Music by Philip Glass*, 59.

<sup>23</sup> Ibid.

Numerous compositional possibilities exist for this procedure, using figures of various lengths and small-scale rhythmic features, as illustrated by Example 1.2, from “Night Train”.



Example 1.2. Figure 53.

Some have described the effect of this cyclic procedure as sounding like “wheels inside wheels”, and Glass is willing to consider this a relatively accurate description of the resulting sound.<sup>24</sup> With these cyclic process, individual measures take on unique aural characteristics despite appearing on paper as repetitions of relatively simple melodic figures. Additionally, each successive measure can last a significantly longer or shorter amount of time than the previous or following measures.

The ultimate fulfillment of Glass’s ideas on rhythmic structure comes in the combination of additive process and cyclic structure. *Einstein* as a whole does not solely consist of successions of measures undertaking both these processes, although such sections are prominent. There are large sections of music emphasizing additive process without the added feature of rhythmic cycles, as well as music in cyclic structure that does not come from additive process. Glass explains that the combination of these

<sup>24</sup> Philip Glass, *Music by Philip Glass*, 59.

structures was the musical device he developed in *Music in Twelve Parts* and that it is also present in *Einstein*.<sup>25</sup> After fully developing these techniques in earlier music, he is able to use them deliberately, still as defining characteristics of the music, but not as the sole focus of the music at every moment.

Glass has already acknowledged that *Another Look at Harmony* contains thematic source material for *Einstein*. In *Another Look at Harmony*, Glass focused on finding a solution for a new musical problem. He states, “What I was looking for was a way of combining harmonic progressions with the rhythmic structure I had been developing, to produce a new overall structure.”<sup>26</sup> In essence, he wanted to find a way to create coherent harmonic structures with of the melodic figures he used in his rhythmic structures. *Einstein* became a way to combine distinct harmonic ideas with his rhythmic ideas to create a complete musical language of his own design. In *Music by Philip Glass*, he provides just a few examples of how this musical language is expressed.

Glass describes one of the main harmonic ideas of the work is taken from the closing section of “Train.” He states that this particular progression resembles a traditional cadential formula, though presented with an altered chord in the middle that serves as a pivot chord, ultimately leading to a resolution of the cadential figure a half step lower than expected. The harmonies of this thematic idea are F minor – D-flat major – B-double flat/A major – B major – E major. Thus, the progression begins in the key of F minor and ends in the key of E major, with the B-double flat/A harmony serving as flat-

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<sup>25</sup> Ibid.

<sup>26</sup> Ibid.

IV in F minor and IV in E major.<sup>27</sup> This particular analysis of the pivot chord in this progression is taken from Glass's own writings, presumably to show how this particular harmony would function if the context remained in the realm of F minor. However, since this harmony never appears in the exact form of B-double-flat major, only as A major, a better understanding of this harmony in terms of F minor is that it is a chromatic mediant in this key. As the progression moves forward, its new E major context becomes clear, so that this A major pivot chord can also be heard as IV in the new key. Example 1.3 shows this progression as it appears in "Train."

The image shows a handwritten musical score for Philip Glass's piece "Train." The score is written on ten staves, grouped into five systems of two staves each. The instruments are labeled on the left: Picc. (Piccolo), S. Sax. (Soprano Saxophone), T. Sax. (Tenor Saxophone), S. (Soprano), A. (Alto), Org. 1 (Organ 1), and Org. 2 (Organ 2). The key signature changes from F minor (three flats) to E major (three sharps) between the second and third systems. The vocal parts (S. and A.) are written in a simplified notation with lyrics: "Fa", "Mi", "Re", "Mi", "Si". The organ parts (Org. 1 and Org. 2) play a complex, rhythmic accompaniment. The score is written in a clear, legible hand.

Example 1.3. Figure 59A

<sup>27</sup> Philip Glass, *Music by Philip Glass*, 59-60.

As is characteristic of the style, this progression is repeated multiple times. Glass states, “It is this lowered resolution of the cadence that motivates its repetition”.<sup>28</sup> This particular chord progression is what Maycock references abstractly when he writes, “He carefully chose the chord sequence because it had an inbuilt ambiguity; it begins in one key and ends in another and it gets there by pivoting on a chord that has two meanings.”<sup>29</sup> In the final scene of *Einstein*, this progression is repeated for over eight minutes, but musical interest is sustained through an additive process, giving the progression its own sense of drama and development, even within what is essentially a larger-scale instance of stasis—the cadential figure is the static feature.

In his remarks on the music of *Einstein*, Glass reiterates that this opera represents a new approach of combining his rhythmic and harmonic ideas into an overall unified process. In this combination, he identifies his concern with “root-movement harmony” in which the root of each chord moves both through and with the progression, as a departure from his more rhythmically focused earlier music. In essence, he is concerned with the presentation of clear harmonies, built on key centers and developed and made interesting through his rhythmic processes. It is this combination of features, present fully in *Einstein*, that allowed him to more fully develop his own, more expressive, musical language.<sup>30</sup>

Keith Potter devotes a section to the analysis of *Einstein on the Beach* in his *Four Musical Minimalists*, including some commentary on Glass’s combination of rhythmic and harmonic ideas into a larger, global structure. However, where Glass is more

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<sup>28</sup> Ibid.

<sup>29</sup> Maycock, 36.

<sup>30</sup> Philip Glass, *Music by Philip Glass*, 62.

concerned with the discussion of his rhythmic ideas, adding in harmonic structures later in his discussion, Potter approaches *Einstein* first from a harmonic perspective. Potter begins this section by acknowledging Glass's remarks on the background to the composition of *Einstein*, including the idea of the combination of harmony with rhythm, the basis of some of the themes in *Another Look at Harmony*, and the idea that the music of *Einstein* developed out of his work with *Music in Twelve Parts* as well as *Another Look at Harmony*.<sup>31</sup> Potter agrees that *Einstein* represents a new musical voice for Glass in his addition of a focus on tonal motion and harmonic ideas in combination with rhythmic structures, even if it was developed from years of work on earlier music.

Potter begins a more specific discussion of the music itself by focusing on the opening harmonic idea, which he describes as a cadential progression in C major involving a repeating bass line of A – G – C. Eventually, the chorus fills in the remaining harmonic context over this ostinato, confirming a repeating vi – V – I in C major. This C major idea mainly occurs in the “Knee Plays”, which frame the opera.<sup>32</sup> Potter also identifies other key areas that appear throughout the work as a whole, including a pentatonic A-flat scale followed by F-minor emphasis. This is followed by the F-minor/E-major cadential pattern that Glass also describes.<sup>33</sup> Missing from this discussion of this crucial progression is how it is developed and made interesting through additive process or cyclic structure, other than to say that this pattern has the property of “looping back on itself.”<sup>34</sup> Potter does use this progression to begin a section on rhythmic

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<sup>31</sup> Potter, Keith, *Four Musical Minimalists* (Cambridge: Cambridge University Press, 2000), 326.

<sup>32</sup> Potter, 327.

<sup>33</sup> *Ibid.*, 330.

<sup>34</sup> *Ibid.*

structures. However, he states that the F-minor chord that begins each utterance of this cadential figure is used in “Trial 1” as the first chord of a five-chord progression that ultimately undergoes rhythmic expansion through additive process. Example 1.4 shows the F-minor measure and its following measure as they appear in figure 53 as well as these same measures as they appear in figure 54, while undergoing additive process.



Example 1.4a. Figure 53



Example 1.4b. Figure 54

Potter follows this F-minor idea from its important appearance in the F-minor/E-major cadential figure to its later appearances as part of other progressions, which also undergo



additive process and rhythmic cycles.<sup>35</sup> Additionally, Potter briefly explains cyclic process, using the same example as Glass, as shown in Example 1.1.<sup>36</sup> He does so to acknowledge the presence of cyclic structures as well as additive processes within the opera.

Potter continues his discussion of additive process and cyclic structure by discussing an altered version of *Knee Play 3* for unaccompanied chorus, which involves a reinterpretation of the original harmonic progression, which was presented as a series of arpeggiations, in a vertical realization sung on numbers. This progression is presented in an 8 + 8 + 8 + 10 repetitive structure, which eventually is reduced to repetitions of 6 + 6.<sup>37</sup> Following the discussion of this repetitive structure, Potter returns to a focus on harmonic ideas, with small notes indicating harmonic processes of interest. For example, he describes “Building/Train” as containing the pentatonic A-flat scale that he identified in previous sections. This scale is repeated for ten minutes through an additive process on two chords, while a tenor saxophone improvises around this harmony.<sup>38</sup> He states that the extended interest on this A-flat pentatonic harmony sets up a sense of expectation for the F-minor/E-major progression, which eventually returns and is itself subjected to an extended additive process in “Spaceship.”<sup>39</sup> Potter does not describe these rhythmic processes in detail.

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<sup>35</sup> Ibid., 331.

<sup>36</sup> Ibid., 331-332.

<sup>37</sup> Ibid., 333-336.

<sup>38</sup> Ibid., 335.

<sup>39</sup> Potter, 336.

In the conclusion of his section on the music of *Einstein*, Potter acknowledges a new sense of interest for Glass in harmonic motion. Potter credits the combination of this new harmonic interest with Glass's work on *Music in Twelve Parts* with a new musical language for Glass.<sup>40</sup> Implicit in this discussion is the idea of this combination of harmonic ideas with carefully constructed rhythmic features as fundamental for the development of Glass's new style, and this combination is embodied in *Einstein on the Beach*. Potter's focus is mainly on the harmonic ideas that Glass adopts, as, at the time *Einstein* was written, this was a newer focus for Glass than his rhythmic ideas, which he had spent years developing and cataloging in other works. Potter provides valuable insight into the harmonic ideas of the opera, as well as acknowledging the rhythmic processes involved in the aural experience of these harmonies.

Although there is largely a lack of information that has been written about the harmonic structure of *Einstein* as a whole, that material that does exist makes clear the idea that there is a harmonic scheme to be grasped for the opera as a whole, and that Glass combines his characteristic rhythmic development with a harmonic structure in this work. Glass's use of additive and subtractive rhythms, as well as cyclic structure, serve as the rhythmic structural features that keep these largely static harmonies interesting and new as the piece progresses. To conceive of the harmonic structure of the work as a whole, the next step is to identify the specific harmonies that are present and prominent in the opera and to compare how these harmonies interact with surrounding harmonies in order to decide which are the most prominent keys or key centers of the work as a whole. The prominence of a specific key or center in this style is established through the clarity of how each key appears, such as a comparison of a pentatonic collection built on a note

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<sup>40</sup> Ibid., 339.

versus a key established by the repetition of scalar structures. Another important factor in deciding which key takes structural precedence is how often and for what duration each key is clearly heard. This music is repetitive in nature, and the repetition of some key areas more often and in more varied types of scenes distinguishes these frequently-heard key areas as more structural. Ultimately, the overall structure of the opera presents a duality between half step relationships in that the main harmonic theme begins in F minor and cadences a half step away, in E major. Additionally, the key areas of A-flat and A-natural are particularly prominent throughout the work, and they are also separated by one half step. Ultimately, the most prominent structural harmonies can be identified as F, A, and C, which, when constructed as a triad, differs from the most prominent chord of the F minor/ E major chord progression, F minor, by one half step in the third of each triad. In this sense, the large scale structure of this lengthy opera depends on the half step, the smallest interval between two different notes possible in traditional harmonies.

## CHAPTER 2:

### ANALYSIS: F MINOR AND E MAJOR

In their analyses, Glass and Potter offer valuable comments about local moments of harmonic interest in selected moments from various scenes throughout *Einstein on the Beach*, and in doing so identify some of the key areas that are important in the opera. However, both analyses lack a complete description of the generation and functioning of these key areas locally, tracing each unique appearance of a given harmonic area. They also do not offer an understanding of the global structure of the work based on how these key areas relate to each other across, rather than merely within scenes to promote a cohesive understanding of the entire work. In undertaking a large-scale analysis of this opera, the most prominent harmonic progressions and key areas or collections, treated as themes, must be assessed. This assessment, along with a global understanding of the work, also reveals underlying harmonic conflicts within the progressions themselves and between individual harmonic areas. This analysis also shows the generation of these key areas and progressions through Glass's characteristic language, involving additive, subtractive, and cyclic processes.

A harmonic analysis of this particular opera differs from that of a piece with a conventional tonal structure in that, falling in line with the minimalist aesthetic, the harmonic areas in each scene are generally presented in full and then repeated or slightly varied for the rest of the musical time for which they appear. This gives the work a sense of harmonic stasis when compared to many works outside of this musical genre. However, in this style, the specific harmonic ideas are varied so that their presentation varies as the

music moves forward in time, so that, even though the specific harmonies or pitch collections persist over time, the specific aural landscape changes within this sense of overall stasis. This chapter will identify one of the important harmonic areas of the opera, a five-chord progression beginning on F minor and ending on E major, and will discuss how this progression is developed and varied throughout the work. This chapter will also show which of the harmonies involved in this progression ultimately becomes the most prominent harmonic area of the progression, as it begins and ends in different places in terms of key area.

The main thematic idea of *Einstein on the Beach* is the F minor/E major cadential pattern that was introduced in Chapter 1. Its first appearance is in “Train” at figure 59, as shown in Example 2.1.<sup>41</sup> This progression is most readily apparent in the bass line of the organ 2 part, outlining a persistent root-position harmonic progression. Above this critical line, the remaining instruments fill in the remaining notes of each foundational triad in arpeggiated form. Deviations from traditional chord tones in these harmonies are present, but they are easily reconciled. The first unexpected note is found in the alto part, in the second measure<sup>42</sup> of figure 59A, that includes a C-sharp within the D-flat major harmony. The C-sharp sounds enharmonically as D-flat, and only exists in this form to show that the line rises one half step from the previous measure. Additionally, this C-sharp is held through the next measure, within the A major harmony. Within this A major measure, the piccolo part and the top line of the organ 1 part include an F-sharp as their final eighth

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<sup>41</sup> Within the score of *Einstein*, as well as in his writings about this particular work, Glass uses the term “figure” to denote these small sections, which are sometimes composed of multiple individual measures. These figures are each indicated by letters or numbers in the score, and often exist as units that are repeated as a whole.

<sup>42</sup> For the purposes of this notational system, “measure” refers to the music separated by dotted bar lines, so that, in some cases, such as in Example 2.1, a figure can be made up of several measures.

notes. If this particular measure were repeated on its own in a cyclic process, then it would suggest an F-sharp minor seventh harmony. However, it is the entire progression, as encapsulated in figure 59A, is repeated as a whole. Thus, these F-sharps within this measure serve to push the progression forward, until it is unambiguously in E major, with the arrival on the B major harmony in the following measure, of which F-sharp is an integral member. This figure cadences definitively on E major.

The image shows a handwritten musical score for Figure 59A. The score is written for several instruments: Piccolo (Picc.), Saxophone (S. Sax.), Tenor Saxophone (T. Sax.), Soprano (S.), Alto (A.), Organ 1 (Org. 1), and Organ 2 (Org. 2). The key signature is E major (one sharp, F#). The time signature is 4/4. The Soprano part has lyrics: 'Fa', 'Mi', 'Re', 'Mi'. The Alto part has lyrics: 'Sua', 'Do', 'Do', 'Si'. The score consists of four measures. The first measure contains a complex melodic line for the Piccolo and Saxophones, and a sustained chord for the Soprano and Alto. The second measure continues the melodic development. The third measure shows a transition, with the Soprano and Alto parts moving to new notes. The fourth measure concludes the progression with a final cadence on E major.

Example 2.1. Figure 59A

This same progression repeats in figure 59B, although this figure has undergone a subtractive process so that each constituent measure now contains three eighth note beats,

rather than four<sup>43</sup>. This shortening of each measure removes the problem of the F-sharp in the A major measure while still maintaining the same timing and urgency of movement to the following measure, as the progression moves through each of its parts slightly faster than in the previous figure. Example 2.2 shows the result of this subtractive process, which has removed the final eighth note of the first and third measures in this progression, when compared to figure 59A in Example 2.1.

Handwritten musical score for Example 2.2, Figure 59B. The score is for a woodwind and string ensemble. It features staves for Piccolo (Picc.), Soprano Saxophone (S. Sax.), Tenor Saxophone (T. Sax.), Soprano (S.), Alto (A.), Organ 1 (Org. 1), and Organ 2 (Org. 2). The key signature has one flat (B-flat). The tempo/mood is marked 'Bx3'. The Soprano and Alto parts have vocal lines with lyrics: S. (Fa, Mi, Re, Mi) and A. (Do, Do, Si). The Organ parts are marked '8va'.

Example 2.2. Figure 59B

<sup>43</sup> Due the lack of time signatures and standard beat length in the music, descriptions of duration will be given in terms of the most characteristic note value of the given figure.

There is no longer a reason to hint at the unexpected cadential harmony, as the 59A figure has already been repeated three times, establishing it in the listener's ear. Instead, the goal of this progression, which ends on E major, one half step away from the expected return to F minor, is emphasized through a gradual additive process, with the B major and E major measures undergoing an additive process, taking on an additional eighth note, in figure 59C. The A major measure is included in this same additive process in figure 59D, and this process extends to also include the D-flat major measure in figure 59E. A comparison between figures 59 C, D, and E, reduced to the two organ parts, is shown in Example 2.3. A comparison of the lengths of the third measures in figures C and D to the lengths of the second measures in figures D and E makes clear how additive process has been applied, increasing the length of these measures by one eighth note.



The image displays three musical staves, each labeled with a key signature and a duration multiplier (Cx3, Dx3, Ex3). Each staff contains two parts: a piano (p) part and a forte (f) part. The piano part is written in treble clef and the forte part in bass clef. The notes are eighth notes, and the patterns show a progression of chords and scales across the three staves.

Example 2.3. Figure 59 C, D, E.

Figures 59A through 59E suggest that the primary emphasis of this harmonic motion is the ultimate arrival on E major, in that the E major is the first to be extended to the original four eighth-note beat duration. E major remains at this duration for the entirety of this additive process, while the F minor is left at the slightly shorter duration of three eighth-notes at figure 59E. Example 2.3 shows the F minor measure remaining at the three eighth-note duration while each subsequent measure expands to four eighth-notes. However, when the F minor measure undergoes additive process in figure 59F, the B major measure, which is crucial to the ultimate E major cadence, is shortened by one

eighth-note. Instead of furthering the additive or subtractive processes in consecutive measures, figure 59G shows the F minor measure undergoing a further additive process with the addition of three more eighth notes, while the other measures remain the same as the previous figure. In figure 59H, the D-flat major harmony is also extended by three eighth notes. By 59I, the B major harmony has been similarly extended, although only by two additional eighth notes, as well as the A major harmony in 59J, again, with two additional eighth notes. Example 2.4 shows the organ lines in figure 59J, displaying the results of the gradual additive process applied to the first four measures of this progression.



Example 2.4. Figure 59J

Throughout this section of additive process, the E major harmony remains in its original form, although the F minor harmony is also restored to a duration of four eighth notes in 59L, the final iteration of this figure. This figure is identical to figure 59A, which is shown in Example 2.1. A similar sense of gradual additive process is applied to this progression as it returns in each variation of figure 100.

The first presentation of this cadential progression introduces the conflict between two pitch centers that are one half step away from each other, F and E. This progression

begins in F minor and cadences a half step away from what would be expected of a traditional progression. It unambiguously ends in E major, as this harmony is preceded by its dominant, B major. As it appears, the A major harmony fits into an E major context, but the F minor and D-flat major that precede it suggest that it could be a chromatic mediant harmony in F minor. This A major harmony acts as a hinge between the F and the E centers, although in context it does more easily suggest E major more strongly than F minor. The additive process, however, ultimately favors F minor by giving it the strongest durational emphasis, which cannot be ignored in this highly repetitive music, which finds its interest not in a variety of harmonic progressions but in how many times each part of the progression is heard, and for how long.

“Knee Play 3” further emphasizes the struggle for predominance between F and E. This scene opens with the familiar F minor/E major cadential progression. However, in this case, it is in altered form. This scene includes only the SATB chorus, although the score provides a harmonic reduction of the organ or piano for rehearsal purposes. Figure 1 from “Knee Play 3” is shown in Example 2.5.

Example 2.5. Figure 1

The harmony begins in F, including only F and C, though it can be presumed to suggest F minor due to earlier iterations of this progression, which included the context of A-flat. The next measure includes C-sharp and F, which differs from the usual presentation of this progression. However, this C-sharp once again enharmonically suggests D-flat, which is the established harmony within this already familiar progression. The A major harmony follows, as expected. However, the fourth measure of figure 1 contains A, C-sharp, and D-sharp, instead of the expected B major harmony. Despite the loss of the crucial dominant, this ambiguous harmony still suggests an E major context, as all the pitches are diatonic in E major, and in fact could imply an incomplete  $\text{vii}^{\circ 7}$  in E. This harmony is followed by an unambiguous E major harmony. The loss of the B major chord somewhat destabilizes the E major emphasis. However, this E major measure is heard twice, strengthening it through duration.<sup>44</sup> As each subsequent figure undergoes subtractive and additive processes, this repetition of the E major measure remains.

<sup>44</sup> This repetition of only one measure is indicated by the bracket above this measure followed by “x2” on the score, as shown in Example 2.5.

Furthermore, the arrival on E major is occasionally punctuated by subsequent silence, such as at the ends of figures 4, 8, and 13.

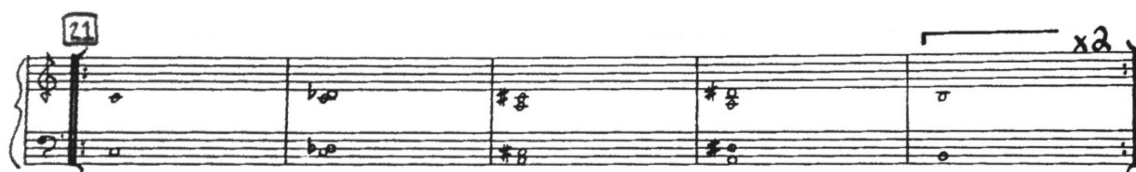
When this harmonic progression returns at figure 18, shown in example 2.6, the D-flat is restored in lieu of C-sharp in the second measure, and the pivotal A major measure remains in its ordinary form. However, the F minor and E major chords are presented in second inversion, with the C and the B in the lowest voice in the first and fifth measures, respectively. The ambiguous penultimate chord continues to A in the bass voice, but this version of the progression includes the missing third to complete the D-sharp half diminished seventh chord.

Example 2.6. Figure 18

So, while both the F minor and E major chords are deemphasized through inversion, the E is concurrently emphasized through the completion of its penultimate harmony, as well as through its repetition, which is typical of this scene. Again, this same harmonic construction is maintained through the additive processes applied equally to each

measure in figures 19 and 20. In this additive process, the measures in each successive figure are all lengthened by one eighth note.

This scene closes with an increased level of harmonic ambiguity. This is first seen in figure 21, shown in Example 2.7, in a piano reduction of this figure.



Example 2.7. Figure 21

The notes F and E are stripped away from their usual locations, leaving only C in the first measure of figure 21 and only B in the final measure of this figure. The penultimate measure once again loses its third, the F-sharp, and the A major measure loses its fifth, the E. Curiously, the D-flat measure loses both its third and fifth, and gains a C, one half step away from D-flat. This change further deemphasizes the F minor context in making the usual D-flat harmony even more ambiguous than if it were missing one of its notes, as in the other measures. This is the only measure that includes the addition of a new pitch. It is as if the C, the only part of the former F minor chord, wants to continue sounding in order to try to retain the sense of F minor when most of its fundamental parts have been stripped away. Still, the E major retains its prominence through repetition, even without the E being literally present. The E major has been so solidly established throughout this scene, as well as earlier scenes that include this progression, that the B is enough to suggest its presence.

In contrast to “Train,” “Knee Play 3” shows a shift of emphasis from F to E in this struggle for primacy between notes a half step apart. Once again, this is achieved through a combination of harmonic emphasis and repetition. Both the F minor and E major

harmonies lose emphasis harmonically, with missing tones and being heard in inversion, and the E major loses its usual dominant in favor of a half diminished seventh chord. The F minor is not without loss of emphasis when the D-flat chord is destabilized with the addition of the C-natural. Ultimately, the cyclic repetition of the E major, even when it is only implied, allows E to be heard as the predominant harmony in the comparison between E and F.

Not every scene that includes the F minor/E major progression is concerned specifically with the struggle for predominance between these pitch centers separated by half step. Instead, intervening scenes explore the progression itself and its development. While this progression does represent a dichotomy between E and F, some of these scenes choose to show how this dichotomy is formed rather than making a judgment over which is more important. In “Knee Play 2,” the violin solo beginning at figure 4 first presents the progression in arpeggiated form, including all of the normally expected pitches. Each successive figure undergoes a subtractive process, losing two eighth notes in figure 5, and losing one more eighth note between figures 5 and 6, although the duration of figures 5 and 6 increases with the repetition of each measure two or three times, respectively. Example 2.7 shows a comparison of figures 4, 5, and 6.



Example 2.7. Figures 4, 5, 6

Figure 7 represents both additive and subtractive processes, as the first two eighth-notes of each measure are the only notes heard, but each of these pairs of eighth-notes is repeated three times in each measure. Finally, in figure 8, only one note from each harmony is heard per measure, and each measure has six utterances of this one note per harmony. Figure 8 includes only notes within a range of a major third from each other at most, including only C, D-flat, C-sharp, D-sharp, and B. Figures 7 and 8 are shown in Example 2.8.



Example 2.8. Figures 7 and 8

This violin solo has thus distilled the notes of this harmonic progression to their simplest, closest form. The solo continues by reversing each process in the order it was applied,



until the progression is heard again in its original form in this scene. Thus, figure 9 mirrors figure 7, and figures 10, 11, and 12 are the same as figures 6, 5, and 4.

“Knee Play 4” opens with this characteristic progression, including the violin and tenor chorus. However, the chorus line is concerned with setting this progression in a scalar-like pattern from C to G-sharp. Throughout, the tenor line sings C, D-flat, E, F-sharp, G-sharp, on the accompanying solfège syllables in a fixed-do system. The violin line clarifies the harmonic context by arpeggiating the chords of this progression over the vocal line, in the same manner as in “Knee Play 2.” Also like “Knee Play 2,” the violin undergoes the same progressive subtractive process, including the repetition of the notes when they are distilled to two or one note segments. Figures 1 and 2 of “Knee Play 4” are shown in Example 2.9.

The image displays two musical staves, labeled 1 and 2. Staff 1 (top) is for Violin and Staff 2 (bottom) is for Tenor Chorus. Both staves show a sequence of notes corresponding to the solfège syllables Do, Re, Mi, Fa, Sol. The Tenor Chorus line is written in a fixed-do system. The Violin line is arpeggiated, showing the harmonic context of the progression.

Example 2.9. Figures 1 and 2

This scene re-sets the earlier violin solo within the context of a stepwise bass line, showing that such a line can be constructed from this chord progression. This scene once again shows the development of this progression in terms of stepwise voice leading without awarding preminence to either F or E.

“Spaceship,” from the final act of the opera, includes the lengthiest and most elaborate presentation of the F minor/ E major cadential figure. This scene opens with a figure that mirrors the initial presentation of this progression from “Train,” reduced to only the organ. This progression is repeated a number of times, varying only the duration of the measures included through additive or subtractive process, first by adding or removing one eighth note at a time until figure 1G, which adds three eighth notes.

Example 2.10 provides a comparison of figures 1A, B, G, and H.



Example 2.10, Figure 1A, 1B, 1G, 1H

Any notes that are added to measures are notes that have already occurred earlier in the measure. The harmonic context of the measure remains the same, while its duration and melodic content are slightly varied. At figure 2, the woodwind chorus, vocal chorus, solo soprano, and first organ are added to the texture all at once, producing an explosion of sound using the same harmonic progression. This texture undergoes the same method of additive and subtractive process used in figure 1.

In examining the durational weight given to each of the component harmonies of the harmonic progression that dominates figures 1 through 12, it initially appears that E major is more emphasized. The subtractive process is first applied to the F minor and A

major chords, leaving the E major harmony lasting for a full half note through this passage. However, in figure 1G, the harmony that is first lengthened by the addition of three eighth notes, three times longer than the usual addition, is the F minor harmony, while the E major harmony is left at four eighth notes and the B major preceding it is left at only three eighth notes. The next harmony to undergo the same larger additive process is the D-flat major measure in figure 1H, which is associated with the F minor key area. In fact, the E major harmony resists this form of additive process even after the B major measure is lengthened. Instead, it only receives one additional eighth note in figure 1K. The same processes are undertaken during the section with the thicker texture, beginning in figure 2, as the E major harmony avoids most forms of additive process even as other harmonies are lengthened. This thicker texture also allows for further emphasis of the F, as the soprano solo holds an F through the F minor and D-flat major measures, both of which involve this note.

The same harmonic progression is maintained at figure 13, as shown in Example 2.11, although at this point the bass motion of this harmony is altered for the first time. Instead of holding the root of the harmony through the measure, it is split so that the root is heard first, followed by the fifth in the bass, with the exception of the E major measure, which includes the root and the third in the bass.



Example 2.11. Figure 13

Of the measures with harmonies that unambiguously belong to one of the two key areas, the E major measure remains the shortest in duration. The same durational proportions are upheld in each measure in figure 15, in which the bass motion is further varied by the inclusion of the roots, thirds, and fifths of each chord in arpeggiation. By figure 17, the length of each measure is equalized, and each figure sees the measures undergo an equal application of subtractive and additive process, adding or subtracting one eighth note at a time from each measure, while continuously varying the content of the bass-line pattern with the inclusion of thirds and fifths. The second organ part of figure 17 is shown in Example 2.12.



Example 2.12. Figure 17

The upper lines are varied as well, and they continue to show a slightly heavier emphasis on F, due to both the nature of its presence in both the F minor and D-flat major harmonies. Emphasis is maintained on only this one note in a particular line throughout these two measures, such as in figure 21, where the second organ repeats an eighth note F through these measures, as shown in Example 2.13.



Example 2.13. Figure 21

From figures 27 through 52, a section focused on A minor interrupts the harmonic context, but at figure 53, the same harmonic and melodic content from figure 17 and following returns.

The repetition of earlier melodic and harmonic material persists until figure 61. At this point, the F minor/ E major content remains, but it is altered to include stepwise, rather than arpeggiated, motion in the bass, shown in the second organ part in Example 2.14.



Example 2.14. Figure 61

This is first heard in the context of four quarter note beats, and it grows to four dotted quarter note beats and then six quarter notes through the following two figures. The F minor, D-flat major, and A major harmonies in this section all include their root on the downbeat of the measure. The B major and E major harmonies are destabilized; the B major measure does not have a B in the bass line at all. In fact, this note only appears on the downbeat of the E major measure. The E in this measure is then on the second beat of the measure, rather than the first. The harmonies are filled in through arpeggiation in the other voices.

At figure 64 in “Spaceship,” the intensity of the bass motion is increased so that the bass lines, as heard in both organs and the bass clarinet, in unison, while the remaining voices hold single notes for the same duration. The bass lines have become

quickly moving chromatic scales, with the first two measures descending and the second two measures ascending, shown in Example 2.14.



Example 2.14, Figure 64

The first measure of this figure begins on F and the second begins on D-flat, as expected. The remaining harmonic context is provided by the other voices, and it conforms to expectations. When the third measure is reached, instead of beginning on A, the content of the previous measure, ending on D, forces it to begin its ascent on C-sharp, the third of the expected harmony. This A major harmony, again, is still present in the other voices. The final measure of this figure begins on B and also fulfills the expected harmonic context. However, the most telling feature of this figure and the following is that the B major does not progress to E major. Instead, the figure repeats, so that it begins again on F minor following the B major. E major is lost in this flurry of melodic activity in the bass line, showing clearly the ultimate domination of F minor over this progression. This lack of E major persists nearly until the end of the scene, until figure 72, which once again presents the progression in its original form.

The “Spaceship” scene contains the most variation of the crucial F minor/ E major progression, and it contains a number of vital key areas including the F minor/ E major figure. This scene shows these vital key areas undergoing the most dramatic sense of development when compared to their presentations in the rest of the opera preceding this scene. In conjunction with the harmonic interest generated by these harmonic

developments, the scene is also the most visually dramatic scene of the opera, in terms of staging and lighting. The most important harmonic area of this scene, the F minor/ E major progression, is particularly developed within this crucial scene. The variations on this progression represent the final struggle between the F and E, separated by half step, over which of these tones is more structurally prominent in the context of the opera as a whole. Earlier scenes, such as “Train” and “Knee Play 3” seem to suggest the prominence of E major over F minor. “Knee Play 2” and “Knee Play 4,” which are interspersed between these earlier movements, are ambiguous in which of the two notes is more prominent. The power of the motivic content of “Spaceship,” however, is strong enough to ultimately remove the E major context entirely, unambiguously showing the prominence and importance of F major, even such that all parts must maintain silence throughout figure 71 before the initial presentation of the F minor/ E major progression is heard once again.

Within this chapter, I have established the structure of the F minor/ E major chord progression that is so important to this opera as a whole. I have discussed how it is uniquely presented in the scenes in which it appears. This progression involves a struggle for prominence between F minor and E major. In its final appearance in “Spaceship,” this progression ultimately removes the final E major harmony completely, showing F minor as more important in the harmonic understanding of the opera in terms of a global structure. The locations of the specific appearances of this progression, in all of its forms, are summarized in Table 2.

F minor/ E major progression:	“Train,” figures 58-59L, 100A-L
	“Knee Play 2,” figures 3-45
	“Knee Play 3,” figures 1-13, 18-23
	“Knee Play 4,” figures 1-11, 29-32
	“Building,” figures 38
	“Spaceship,” figures 1-26, 53-72

Table 2. Occurrences of the F minor/ E major progression

In the following chapters, I will continue with a similar analysis of the other prominent key areas of the work. These other harmonic ideas differ from the F minor/ E major progression in that they consist of only one specific harmony or collection, rather than a repeating progression. However, they are similar in that highlighted key centers differ are ultimately separated by half step, and, in the same way as F minor eventually takes prominence over E major, I will show which of these other important harmonies is ultimately more salient and more structural to the opera as a whole.



### CHAPTER 3: ANALYSIS: A-FLAT AND A-NATURAL

The struggle for primacy between two notes separated by a half step continues in sections that are not governed by the F minor/E major progression. Throughout the opera, there is also a sense of tension between an A-flat focus and an A-natural focus, though this tension is secondary to that between E and F. The ultimate result of this struggle between A-flat and A-natural is part of the framing progression in the first and last scenes of the entire opera, though not itself the center of this framing structure. In this chapter, I will show the unique presentations of these key areas, such as how A-flat major is generally found in terms of its major pentatonic collection while A-natural is heard in the form of an A-natural minor collection, often appearing in scalar form. The result of this analytic perspective will be that A-natural is shown to be more structurally prominent to the opera as a whole, due to its unambiguous structure through scalar presentation, particularly when compared to the pentatonic collection of A-flat, as well as its importance and prevalence in “Spaceship,” the climactic scene of the opera.

The beginning of “Train” includes only notes from the A-flat major pentatonic collection. At figure 2, each line undergoes a cyclic process, with some lines involving eight quarter notes repeated three times, and the remaining lines including three quarter notes repeated four times. The entire figure is repeated in full four times, as shown in Example 3.1.



Example 3.1. Figure 2

Although this scene only uses the five notes from figure 1 through 17, harmonic interest is generated through this cyclic process. This process avoids the problem of one specific harmony becoming prominent, as each repetition sets different collections of notes against each other vertically. Any triadic implications are further obscured through the presence of the entire pentatonic collection within each figure. In figure 2, in the first hearing, the whole collection is heard on the first, second, and fourth quarter note beats, but is missing from the third. However, the cyclic process alters the vertical sonorities such that the content of each successive beat is changed in terms of timbral

representations of the note as well as which beats include the B-flat. In essence, this figure, as well as figures 1 through 17, 25 through 52, and 60 through 89 in this scene explore the sonic landscape that various harmonic and timbral combinations that A-flat pentatonic can create.

The “Night Train” scene is similar to the initial “Train” scene, only on a smaller scale. The performing forces include a bass clarinet, a solo soprano and tenor, and one organ. The texture is later expanded to include two flutes and a full chorus. Figures 1 through 68 once again only involve members of the A-flat major pentatonic scale. Example 3.2 shows figures 6 and 7 of this scene.

Handwritten musical score for Example 3.2, Figures 6 and 7. The score is for four parts: B. Cl. (Bass Clarinet), S. (Soprano), T. (Tenor), and Org. (Organ). The key signature is A-flat major (two flats). The time signature is 2/4. The B. Cl. part has two measures: the first measure is marked with a box containing '6' and 'x4', and the second measure is marked with a box containing '7' and 'x8'. The S. and T. parts have two measures each, with the first measure marked 'x4' and the second measure marked 'x3'. The Org. part has two measures, with the first measure marked 'x4' and the second measure marked 'x3'. The lyrics 'La Fa La Si Do Si' are written under the S. and T. parts. The Org. part features ascending arpeggiations of the notes in the A-flat major pentatonic scale.

Example 3.2. Figures 6 and 7

Throughout the including figures 1 through 68, the bass line of the organ part includes ascending arpeggiations of the notes in this collection, all in eighth notes, with the A-flat and B-flat sounded together each time and the remaining tones sounded separately. The

vocal lines include shortened fragments of the material from “Train,” also undergoing the same cyclic process in conjunction with the instrumental lines. Although the bass clarinet was not included in “Train,” in figures 1 through 44 of “Night Train” it repeats alternating half notes on F and E-flat, which are part of this collection. When the texture expands to include the full chorus and the flutes at figure 52, the same collection is present in full in each measure through figure 68. Once again, this movement explores the sonic possibilities of the A-flat major pentatonic collection.

The “Building/Train” scene solely contains the A-flat major pentatonic collection until its final figure, when it reverts to the F minor/E major cadence. When the voices and woodwind chorus enter in figure 5, they are instructed to perform any of the notes of the A-flat major pentatonic collection, held throughout each figure. Example 3.3 shows figures 5 and 6 from “Building/Train.”

Figure 5: Musical score for Figure 5, marked "5 x12". The vocal line (W.W.) consists of five whole notes: A-flat, G-flat, F, E-flat, and D-flat. The piano accompaniment consists of four measures of eighth-note patterns. The instruction "W.W. Enter here during 5TH repeat." is written above the vocal line.

Figure 6: Musical score for Figure 6, marked "6 x12". The vocal line consists of a single half note (A-flat) followed by a rest. The piano accompaniment consists of four measures of eighth-note patterns.

Example 3.3. Figures 5 and 6

This scene differs from the previous “Train”-related scenes in that it emphasizes E-flat throughout. This is due to the repetition of E-flat in the second organ part as the lowest tone, preceded and followed by a B-flat each time it is heard. Thus, this scene is clearly another exploration of the possibilities of A-flat major pentatonic. However, instead of exploiting the sonic possibilities of this collection through cyclic processes, this scene includes registral emphasis of one tone within this collection, with variations in sound achieved through additive and subtractive processes. For example, compare figure 5 and figure 6 in Example 3.3 to see that the first measure in figure 6 has been lengthened at the beginning with the addition of two eighth notes, while the remaining three measures have

been shortened through the removal of two eighth notes from the beginning of each. Despite these changes, the E-B motion remains prominent in the bass line of the second organ. This shows a further possibility inherent in the sole use of these five notes, in the emphasis of one note in particular within the entire collection. This possibility is inherent in the pentatonic collection and its highly consonant nature, as it can be easily rotated to emphasize a pitch that is not the center that generates the collection. Ultimately, this ability to easily change centric emphasis aids in the shift in structural prominence away from A-flat.

Although the “Train” scene and its related scenes involve sections that show a clear emphasis on A-flat through the use of the A-flat pentatonic scale, a number of scenes also include an emphasis on A-natural, one half step away from A-flat. This emphasis is achieved through the use of the A minor scale with a clear focus on A as the center. The scenes that focus on A are interspersed throughout the opera, similarly to the sections emphasizing A-flat.

Most of the “Trial 1” scene, from figures 1 through 52, is clearly in A natural minor, using only notes from that collection. From the beginning of the scene through figure 19, the bottom line of the organ part holds an A-natural pedal, with an alternating E and A above this pedal. Additionally, the highest note of this section, heard in the first flute part, is an A, typically approached by an arpeggio, C-E-A. This high A is held for a noticeably longer duration than any of the other notes in this flute part. This line is also heard simultaneously in the organ part. The remaining flute and the soprano and alto chorus also mimic the organ part. These details are apparent in Example 3.4, showing figures 3, 4, and 5.

The image shows a handwritten musical score for Example 3.4. It consists of six staves. The top staff features three boxed figures labeled 3, 4, and 5. Figure 3 is marked with 'x8 (x4)' and Figure 5 with 'x16 (x4)'. The middle staves contain vocal lines with lyrics 'Mi La' and 'Mi Mi'. The bottom staves show piano accompaniment with arpeggiated figures.

Example 3.4. Figures 3, 4, and 5

The additive process applied to this section often functions to extend the high A sound for a further increased duration. Due to the pedal and the heavy emphasis on the notes A, C, and E, “Trial 1,” figures 1 through 19 show definite harmonic stasis on A minor.

At figure 20 in this scene, the violin entrance is crucial to the further insistence on A minor, and particularly A as a focal tone. This violin line, shown in Example 3.5, often doubled by the organ, begins with a series of arpeggiations of the same A minor triad, each including A as either the highest or lowest tone, often both. The final eighth notes of many of these initial figures show the first deviations from the A minor triad, including D and G, later with an E in between.



Example 3.5. Figures 20-22

After this D-G, the melody always returns to the A minor arpeggio. The additive process gradually applied to this solo line includes an increasing number of stepwise tones in between the arpeggiated notes, such as the Ds before and after C, leading to E, beginning in figure 24, seen in Example 3.6.

Example 3.6. Figure 24



Gradually, notes are filled in until the A minor triad arpeggiation is transformed into an A natural minor scale. At figure 25h, the music reverts back to the arpeggiated structure, shown in Example 3.7, though it undergoes the same additive process to revert to an overall scalar structure by figure 38d.

Example 3.7. Figure 25g and 25h

This scalar structure is once again focused on the A natural minor collection, emphasized further by A being heard as the lowest tone.

The following scene, “Knee Play 2,” immediately picks up the A natural minor scale, presenting it as a literal scale in the violin and organ. Additionally, the organ holds an A pedal tone in the bass. In Figure 2, however, Glass moves this bass pedal to C while retaining the A minor scale in the violin part, though it does briefly extend to the G a whole step below the starting point of the scale, and then immediately returns to the A. These slight changes serve as a transition to a section featuring the F minor/E major cadential theme. Thus, the A minor sections stay clearly in this harmonic realm, with

only small ambiguities arising when the music prepares to transition to a new harmonic area.

In “Knee Play 2,” the A natural minor scale eventually returns in full at figure 14 in the solo violin section, following the violin deconstruction of the F minor/ E major section. In subsequent figures, slight variations are gradually introduced through additive process first, as the lower neighbor G reappears. Additionally, a C-B-C neighbor figure is inserted after the first D, which then returns to the D and the completion of the rest of the scale. Similarly, another neighbor figure, F-G-F, is introduced in figure 18 following the E on the descent of the scale, which is then followed again by the E and the rest of the scale. Later subtractive processes involve the elimination of the scalar material above the E that follows the C-B-C neighbor figure. Instead, the scale descends from the E, as shown in figure 25 in Example 3.8 . In figure 26, this scale is once again expanded to include the F-G-F neighbor figure, before descending from G. Figure 26 is also shown in Example 3.8.



interest is generated through the alteration of the presentation of A minor as a key, as additive and subtractive processes morph its presentation from arpeggiated to scalar, through the gradual inclusion of stepwise notes. Interest is further added to the scalar motion with the addition of neighbor ideas. This neighbor motion adds a sense of melodic variance to a simple scale, while not destabilizing A as a clear center or disfiguring the A natural minor scale. In “Trial 1,” the pedal A further emphasizes the A center. In “Knee Play 2,” the solo violin is the only voice heard for the majority of the scene, so when it sounds an A natural minor scale, this harmonic area is the only possible focus.

The “Bed” scene begins with a solo organ, holding a pedal on an A and E open fifth and playing a cadenza above it on the A natural minor scale. When it reaches figure 2, extending through figure 34, the A-E pedal is retained, along with the addition of an added A an octave above. The top line of the organ part displays the same arpeggiation of the A minor triad as heard in the violin part of “Trial 1,” only heard up an octave. It also undergoes the same additive and subtractive processes to add interest to this A minor harmony, through the addition of stepwise motion between previously arpeggiated figures. These details can be seen in Example 3.9.



Example 3.9. Figures 3, 4, and 5

Through figure 34, the only clear harmony is A minor, decorated occasionally by passing and neighbor motion.

The final appearance of the A natural minor scale is found in the middle of “Spaceship,” beginning in figure 27. The A-natural key area is first heard as an A natural minor scale, ascending and descending, in unison in all parts. As is familiar, it is first extended to include a lower neighbor G in all parts. Following this addition of the lower G neighbor, it undergoes the same additive and subtractive processes to include upper and lower neighbors as it underwent in “Knee Play 2”. These neighbor-tone additions to the scale can be seen in Example 3.10, which shows the organ 2 part at figures 29 and 30, as the other instruments are in unison with this part.



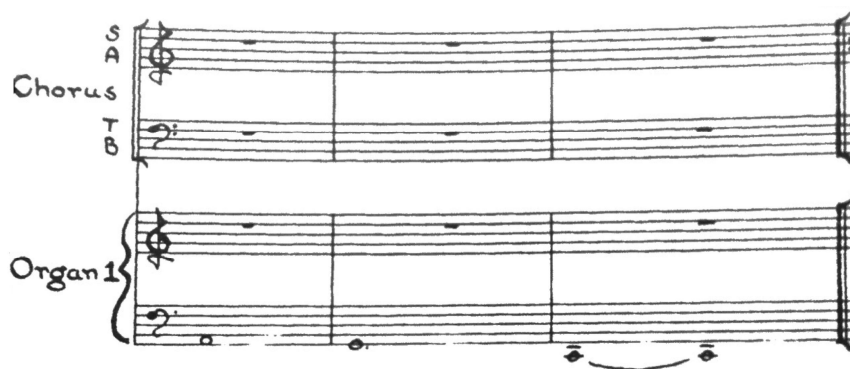
Example 3.10. Figures 29 and 30

The intensity of these variations on the same scale is heightened through the addition of a number of instruments playing in unison, as opposed to the solo violin of the earlier scene. The scale shrinks and grows, but at a higher volume and in a denser combination of timbres, adding further interest to a relatively simple sound familiar to the opera through its presence in scenes such as “Trial” and “Knee Play 2.” Additionally, this scalar figure continues to add interest as a form of transition to a new harmonic area, as figure 50 includes one B-flat on the descending side of the scale, which reverts back to B-natural on its second appearance in the descent. This gesture prefigures figure 51, which includes an increase in chromaticism, involving a D-sharp, G-sharp, and A-sharp following their natural counterparts on the ascent, and having the earlier B-flat reappear on the descent in

this figure as well. Following this chromatic measure, the music returns to the F minor/ E major harmonic area.

Throughout *Einstein*, there is a clear focus on both A-flat and A-natural throughout several scenes, expressed in the use of the A-flat pentatonic and A natural minor collections. When these key areas are prominent, this emphasis is achieved by a sole focus on the tonic. In terms of the A-flat pentatonic sections, the five-note collection built on A-flat is heard in full throughout each figure. In the A minor sections, either the A minor scale or A minor triad is repeated, often with an A pedal. Thus, unlike the F minor/ E major sections, these sections exploit only one harmony, so that there is a sense of harmonic stasis. This stasis is made sonically interesting through the gradual application of additive and subtractive processes to include new melodic ideas with the same notes as figures progress, as well as cyclic process to vary the sound of an entire collection through different timbral and note combinations within various repetitions of one figure.

Just as this opera contains a duality between notes separated by half step in the F minor/E major sections, so too does it present a conflict between A and A-flat, also separated by half step. In deciding which of these notes, A or A-flat, takes priority in the overall structure of the opera, one must consider where each center appears, in what form, and how often, as well as other hints toward primacy outside the sections that emphasize these tones. The first of these hints is simply that the opera opens on a lone A-natural, before moving through the A-G-C ostinato that shapes the opening of the opera, shown in Example 3.11.



Example 3.11. Opening

In a work that relies on minimal harmonic cues, a lone opening note is significant. This A-G-C ostinato also frames the opera, forming the structure for both “Knee Play 1” and “Knee Play 5.” The note A being a part of this framing structure is the first clue that A supersedes A-flat in overall structural weight.

Another factor to consider in determining structural importance in this opera is the amount of time that each center is emphasized. A-flat is the focus of parts of the “Train” scene as well as the scenes that are related to it both in harmonic content and on-stage action, “Night Train” and “Building/Train.” Similarly, A minor is one of the harmonic focal areas of “Trial” as well as “Bed,” which are related to it in terms of structure and staging. A minor is also highlighted in “Knee Play 2,” which is one of the crucial joining sections of the opera. Finally, it is heard in “Spaceship,” the climactic scene of the opera, and in this scene is surrounded by the crucial F minor/ E major harmonic theme. Finally, in a related sense, A is emphasized within this F minor/ E major progression as the root of the pivot chord that moves the harmony from F to E. It is true that the A in this sense is the root of an A major, rather than A minor, harmony. However, the one factor that differentiates these two harmonies is the difference of a half step in the third of the harmony. It is true that the A-flat is also just one half step away from the A root of this

chord, however, the A-flat in the rest of the opera is not emphasized by triadic means, but through the pentatonic collection, the content of which differs even further from the A major triad. Due to these factors, it is clear that while both A and A-flat are important harmonic areas in *Einstein*, between these centers that are separated by a half step, A-natural is ultimately given more weight in an overall structural perspective of the work. The specific locations of both of these key areas are summarized in Table 3.

A-flat pentatonic:	
	“Train,” figures 1-17, 25-58A
	“Night Train,” figures 1-77
	“Building,” figures 1-37
A-natural minor:	
	“Trial,” figures 1-52
	“Knee Play 2,” figures 1-2, 14-44
	“Trial/Prison”, figures 1-11
	“Dance 2,” entire (A-natural pedal throughout)
	“Bed,” figures 1-34
	“Spaceship,” figures 27-52

Table 3. Occurrences of A-flat and A-natural.

The half step relationship can be extended to a comparison both the F minor/ E major duality and the A-flat/ A-natural duality. Shifting from an F minor triad to an E major triad requires a half step shift of both F to E and C to B. Between these harmonies, the A-flat is retained, as the G-sharp in the E major triad can be understood enharmonically as A-flat. A-flat is thus emphasized in this other prominent harmonic area,

though it is yet again obscured, in this case through its presence as a third of both harmonies, rather than a root. Thus, the A-natural key area retains its relative prominence in the global view of the opera due to its clear presentation of A-natural as the center.

I have shown that another duality by half step exists in the global perspective of this opera when the sections emphasizing A-flat and A-natural are compared. Although A-flat is emphasized through the use of its major pentatonic collection and through its status as the shared third of the F minor/ E major duality, A-flat is ultimately obscured in presentation when compared to the prominence and structure of the A-natural sections, which clearly show A-natural as the center due to its prominence as a pedal tone and its frequent occurrences in scalar form, particularly in “Spaceship.” In the next chapter, I will continue my harmonic analysis of the most prominent key areas of the work by discussing the importance of C major as a clear structural harmony due to its largely straightforward presentation and appearance at the beginning, middle, and end of the opera.



## CHAPTER 4:

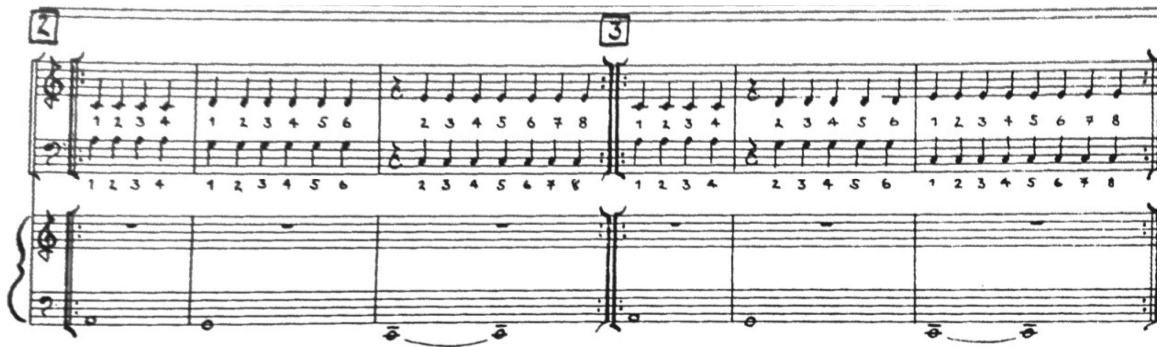
### ANALYSIS: C MAJOR

Although it is not framed in terms of a half step duality like the other important key areas, a tertiary emphasis on C must be explored through *Einstein* as well. The function of this key area is within framing sections of the opera, including the opening, closing, and middle scenes. Vestiges of this key area are also found in smaller transitional sections between inner scenes, though in altered, less straightforward form. Again, C is not set in conflict with any key a half step away from it, as has been an important structure-defining feature in the overall harmonic analysis of this work. Instead, C is important in its self-evident structural definition, through its literal inclusion at structural points, most prominently and obviously in the opening and closing of the opera.

The “Prologue” section before “Knee Play 1” is very simple, in that it is a repetition of the sequence of pitches A-G-C, held for 20, 30, and 40 seconds respectively, in the same manner as seen in Example 3.11. This sequence of pitches begins as the audience enters and continues until it elides with the beginning of “Knee Play 1.” C is highlighted here both through duration and register, as it is the longest and lowest note of the three. Scale degrees 6, 5, and 1 in C major are repeated as an ostinato before any other harmonic context is given. Thus, C major is the first clear harmonic area of the opera. It has already been stated that the A in this progression is highlighted as the first note of the opera, and this emphasis still stands even in the face of it being the first chord in a progression in C major, as C major is established via repetition in the initial absence of any other harmonic cues. The note A being the first tone is clear and unambiguous,

while C major must be reached and established, though this is accomplished easily through durational and registral cues, as well as repetition.

This A-G-C progression is maintained as a bass ostinato in the organ throughout both “Knee Play 1” and “Knee Play 5,” the opening and closing scenes of the opera. At figure 1 in “Knee Play 1,” further harmonic context is given in the chorus, providing an A and C over the A, a G and D over the G, and a C and E over the C. Here, the scale degrees 6, 5, and 1 in C major are contextualized as roots of diatonic triads, analyzed as vi-V-I in C major, further confirming a C emphasis. This same three-chord progression persists throughout this scene. Musical interest and variation is maintained through the removal of one beat of the vocal part at the moment of harmonic change as the progression moves, replacing it with a single quarter rest, shown in Example 4.1.



Example 4.1. Figures 2 and 3

Thus, while the harmonic content of each figure remains the same, the sound is changed through the deletion and addition of notes in strategic positions, so that each figure differs from the last in some small way. Interest is further added after figure 10, with the introduction of figure 1b, shown in Example 4.2, which further divides the chorus.

Example 4.2. Figure 1b

The alto and bass voices continue the same vocal line as the opening, while the soprano and tenor voices hold their notes the same length as the organ ostinato notes. The harmonic context and content is not changed, and it is also varied through the addition of rests on the downbeats of various measures. This entire scene prefigures the idea of harmonic interest being created out of stasis through addition and subtraction of notes, and it is achieved in the key of C major.

“Knee Play 5” operates in the same harmonic context and note structure as “Knee Play 1” from its opening through figure 11. The ostinato and harmonic content remains the same until the end, but figure 12 introduces the solo violin line. In previous scenes, the solo violin has served to explore and deconstruct the harmonies involved, and it maintains this same function in “Knee Play 5.” The violin begins by playing an eighth note A-C repeating pattern above the A in the organ and a B-D repeating pattern above the G. Following these A-C and B-D repeating patterns is the unexpected inclusion of a

G-B figure above the C, which eventually morphs into G-C. This figure is shown in Example 4.3.



Example 4.3. Figure 12

This inclusion of G-B does not completely upset the key area of C major, particularly because it continues to cadence on a clear C major harmony. Instead, this melodic idea is a precursor to later melodic ideas, as in figure 14 when passing tones are included between a number of the previous melodic skips. In the corresponding measure in this figure, the violin plays eighth notes in stepwise motion down from C to G and then stepwise back up to B. In retrospect, the G-B motion above the C serves as the skeleton of this later scalar pattern that ultimately emphasizes C major even further. This melody is further varied through figures 16 and 17, when the rhythm is changed to a triplet



major. Finally, in figure 16, this G is given, confirming that this section is a variation on the opening and closing material of the opera.

It is clear through its presence in the beginning, middle, and closing of the opera that C major is an essential structural key area. C is also emphasized, though in obscured form, in smaller scale transitional structures. Potter refers to such areas as a “‘rootless’ four-chord sequence plus two chord link.”<sup>45</sup> However, Potter only identifies this harmonic idea in “Trial 1,” and he fails to elaborate on it further. This sequence is clearly related to C major in terms of root motion, although C major is much more obscured than in previous presentations due to the additional harmonic material above the bass.

The first appearance of this “rootless” sequence is at figure 53 in “Trial 1.” The bass motion in the organ is simply a long C followed by an even longer G a fifth above. The upper line arpeggiates F minor above the C and E-flat major and C major above the G. When the bass line ends, the melody continues with the outline of a D major harmony. This progression is shown in Example 4.5.



Example 4.5. Figure 54

Although these chords do not themselves show a clear harmonic progression in any one particular key, they are related to the overall harmonic structure of the work. The F minor moving to E-flat major is related to the F minor/ E major harmonic theme that is so crucial to the opera. It is altered, characteristically, as each of the notes of the initial E

<sup>45</sup> Potter, 328.

major harmony is lowered by half step, such that the duality between F minor and E major is expanded by half step to progress from F minor to E flat major. This expansion to E flat major is followed by the familiar framing C major, only it is obscured by the presence of the G in the bass, rather than the C, and its progression to the isolated D major harmony. This progression is repeated through figure 64, and given melodic interest through additive and subtractive process throughout. Although this progression has deliberately obscured harmonies due to its function as a transitional section from one scene to the next, it contains clear references to overall structural harmonic ideas, though, again, in characteristic alteration.

Figures 65 and 66, the final figures in “Trial 1,” show a change in harmonic motion before the transition to “Knee 2” is ultimately achieved. Figure 65 has a held D in the bass and a B-flat major harmony above, and figure 66 has a C in the bass with an arpeggiated A-flat major harmony above. This is shown in Example 4.6.



Example 4.6. Figures 65 and 66

Figure 65 shows an unexpected alteration of the C major by whole step, rather than the characteristic half step inherent in much of the opera. This whole step alteration is a curious deviation in that it is only so apparent in this already ambiguous section. Figure 66 shows the C as the third in an A-flat major harmonic context, which seems to emphasize A-flat over the more structural A. However, this A-flat major harmony exists as the final moments of a transition section, and transitions in this work are generally

altered. In this case, the A-flat is another appearance of the alteration by half step, while still emphasizing C. The ultimate focus on A-natural is confirmed in the next movement, “Knee 2,” which opens with an A minor scale over an A pedal. This A pedal eventually falls to C, representing the resolution to the earlier moment of conflict between A and A-flat, as the C appears again, framing the A minor scale.

The four-chord sequence of F minor, E-flat major, C major, and D major above C and G is found once again in the transition from “Bed” to “Spaceship.” It begins in figure 35, along with the solo soprano line. This progression is set in a very similar form to its earlier presentation, involving C and G in the bass and the harmonic context arpeggiated above, eventually undergoing additive and subtractive processes to avoid stagnation. The soprano solo is largely stepwise, and it uses only notes in the context of the given harmonies. Eventually, the organ fades out, leaving only the soprano part, which continues with stepwise pitches involved in the harmonies of the earlier harmonic progression. This eventually fades out so that the F minor/ E major progression that begins “Spaceship” can begin.

“Spaceship” is a crucial scene to the harmonic understanding of the opera, due to its sheer density of harmonic emphasis set up by the material of all the scenes previous to it, and it is framed on both sides by C. Preceding the appearance of “Spaceship” is the aforementioned “rootless” harmonic progression, which displays bass motion from a low C to the G a fifth above, referencing the C major that frames the entire opera, only in the ambiguous context of a transitional section. Following “Spaceship,” C major returns in literal form in “Knee Play 5,” the final scene of the opera. In this sense, C major is framing even on a smaller scale, as it surrounds the most crucial scene in determining the



main harmonic focus of the entire opera. In this way, it does not supersede the F minor or A minor in terms of harmonic importance, but it is crucial to the support of these harmonies and the harmonic support of the opera as a whole, due to its framing structure. It avoids alteration by half step in favor of clarity in its framing purpose.

Although C major is not put in conflict with a key a half step away, like the other prominent harmonic ideas of the opera, it contributes to the sense of global structure of the work through its presence at the beginning, middle, and end. This presence is unambiguous due to the ostinato of A-G-C underpinning a vi-V-I progression in C major, with the rest of this harmonic context given in the upper voices. Hints of C major also exist in some transitional sections between scenes in the form of a C-G bass under an ambiguous harmonic structure. C major does not undergo the same level of development and conflict as the F minor/ E major or A-natural/ A-flat key areas. Instead, its prominence comes from its structural stability, both in terms of where it is heard and its clarity of presentation. A summation of the specific locations of C major can be found in Table 4.

C major:	“Prologue”
	“Knee Play 1,” entire scene
	“Knee Play 3,” figures 14-17
	“Knee Play 5,” entire scene
C-G bass transitional figure:	
	“Trial,” figures 54-66
	“Trial/Prison,” figures 35-43
	“Bed,” figures 39-46B

Table 4. Occurrences of C major and the C-G bass pattern

## CHAPTER 5: CONCLUSIONS

Based on a comparison of the major key areas of *Einstein on the Beach*, which make up the harmonic themes of the opera, some decisions can be made about the most salient key areas of the work as a whole. These decisions can be made based on the strongest aspects of the key areas, such as in the F minor/ E major cadence figure, or between two key areas, such as between A-flat and A-natural. The development of this sort of analysis shows that a global theme of the opera's structure is the discourse between keys that are only one half step apart. Various scenes within the opera, categorized by on-stage features, such as "Train" scenes versus "Trial" scenes, feature different combinations of these key areas, emphasized at various strengths. This analytic struggle finally finds its answer in "Spaceship," the climactic scene of the work as a whole, which combines the most prominent keys, enhanced by a heightened intensity of on-stage action.

As discussed in Chapter 2, the main harmonic idea of *Einstein*, found throughout various categories of scenes, is the F minor/ E major harmonic idea, and it is one that is defined by the unusual cadence on E, a half step away from the expected resolution. At first, the durational and rhythmic emphasis seems to point toward E minor as the most salient harmonic area within this idea. However, later scenes increasingly focus on F, to the point of eventually eliminating E minor from the figure as a whole, signifying the final dominance of F over the thematic idea, even if the F cadence is never reached.

Various scenes also exploit the tension between the focus on the A-flat pentatonic key areas in the "Train"-related scenes, and the A-natural minor key area in the "Trial"

scenes, as well as “Knee Play 2” and “Spaceship.” The appearance of A-natural in one of the “Knee Plays” as well as in “Spaceship” is a crucial hint toward the primacy of A-natural over A-flat in an overall view of the opera. The “Knee Plays” are important structural joints of the opera as a whole, and they also contain much of the focus on the F minor/ E major idea. “Spaceship” is, again, the climactic point of the opera due to its inclusion of the most developed explorations of the key areas of F minor and A major, as well as its extended length when compared to many other scenes and its dramatic staging. In addition to these areas, A is emphasized in its own set of scenes as well. It undergoes a greater level of variation than the A-flat pentatonic sections while still maintaining its clarity as centered on A-natural. The A-flat pentatonic sections are more obscured due to the entire collection often being heard at one time. The A, instead, is heard in scalar or arpeggiated forms, which are both constructions that very clearly emphasize a key area and center. Additionally, A, as part of the C major key area, is the first tone heard in the opera.

Finally, though it does not have an analogue a half step away, C major is also an important key area based on its function in the framing scenes of the opera, in “Knee Play 1,” “Knee Play 3,” and “Knee Play 5.” Thus, C major is found at the beginning, middle, and end of the piece. The C major key area is immediately clear via the A-G-C ostinato that appears throughout these scenes, sounding as vi-V-I in C major. The low register of the C also makes it stand out as a key center. Additionally, although it is less harmonically clear, the connecting sequence at the end of “Trial” and “Bed” has clear references to C based on its bass motion from G to C. C thus exists within a transitory structure as well, although ambiguously, as is expected in these sort of transitions.

One final detail that solidifies the tension apparent in *Einstein* based on harmonies related by half step is that, when taken together, the main three key areas of the opera —F, A, and C— create an F major triad. The main key area of the most important harmonic theme of the opera is F minor, constructed as F, A-flat, and C. Thus, the difference between the global harmonic structure of the piece and the most salient individual harmony within the piece is one half step, reflecting the larger half step conflict between F and E and between A and A-flat. This final detail is one more defining feature of this opera as a whole, exemplifying the tensions inherent in this musical language of Glass's own creation.

This entire global analysis of the harmonic structure of *Einstein on the Beach* is largely dependent on Glass's use of rhythm and repetition, rather than typical voice leading or harmonic cues. The F minor/ E major harmonic progression, would, if it were a typical progression in F minor, end also in an F-minor context, most often on an authentic cadence ending on this chord. However, this particular progression is modified, leaving open the question of key emphasis. The question arises of whether this is an F minor progression with a modified cadence, or if it is an E major progression that begins unusually. Absent any harmonic cues outside of the progression itself, the analyst must rely on the other suggestions given in the music. One of the strongest features of the sound of this opera is in the rhythmic structure and the procedures for which Glass had developed over many years and multiple earlier compositions. These processes have the power to emphasize specific harmonic areas in the music by expanding or contracting them in time and texture, or even adding or removing them entirely from the texture.

The global analysis of *Einstein on the Beach* offers an understanding of this culmination of Glass's unique musical language that is not limited simply to the tools he uses to create sonic landscapes such as those found in this opera. Instead, this analysis provides a full picture of how these harmonic ideas are used in conjunction with rhythmic processes to create a unified idea of how the harmony works in *Einstein*, along with the full capabilities of Glass's compositional tools. This leads to an understanding of the capacity for a large-scale work to be derived from a limited number of harmonic ideas when these ideas are explored to their fullest extent.

With *Einstein* serving as the full realization of his uniquely created musical voice, Glass was then able to modify this particular musical language to fit his future works. For example, about his next opera, *Satyagraha*, Glass writes, "In *Einstein on the Beach*, I had been looking for ways to combine harmonic and rhythmic structures... For *Satyagraha* I concentrated on only one such approach."<sup>46</sup> In this opera, his harmonic and rhythmic structures are filtered through the lens of the chaconne throughout every scene. In his opera following *Satyagraha*, Glass focused even more deliberately on specific key relations through the piece, identifying particular characters or actions with thematic devices and including "a specific musical resolution in the very last moments."<sup>47</sup> Further research into Glass's compositional style can use this global view of *Einstein* as a starting place for understanding the structure of his later operas. With these later works, Glass shifts his focus from rhythm to harmony. The structure of *Einstein on the Beach* as a realization of his ability to combine harmonic themes with his rhythmic innovations, and indeed even develop these harmonies through the rhythmic processes, allowed Glass to

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<sup>46</sup> Philip Glass, *Music by Philip Glass*, 115.

<sup>47</sup> *Ibid.*, 171-172

compositionally move forward from the strict focus on rhythmic features that characterized his earlier works. His future large-scale harmonic constructions can likely be found in these later operas *Einstein on the Beach* provides a clear picture of the unique musical voice that Glass uses in his compositions, and serves as the basis for future harmonic innovations in his later works.

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